Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Curtiss-Wright Controls Inc.	)	
	)	ET Docket No. 10-167
Request for Waiver of Part 15 of the	)	
Commission's Rules Applicable to Ultra-	)	
Wideband Devices	)	

PETITION FOR RECONSIDERATION AND CLARIFICATION

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February 10, 2012

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SUMMARY

Curtiss-Wright Controls Inc. ("CWCI") manufactures an advanced Part 15 ultra-wideband ("UWB") ground penetrating radar ("GPR") system, known as 3d-Radar, that provides essential subsurface data critical to the safety of our nation's infrastructure, including bridges, rail and highways. The Commission recognized that 3d-Radar represents a new category of GPR devices that will increase efficiency in subsurface imaging, thereby potentially lowering costs of infrastructure repair and improving safety conditions for both infrastructure workers and the general public.

CWCI requested a waiver of certain UWB rules in order to certify 3d-Radar, and appreciates the Commission's efforts in granting that request. However, certain conditions imposed in the waiver Order regarding frequency steps, cycle speed and dwell time will unnecessarily hinder deployment of 3d-Radar. Specifically, the wording of the first condition in the waiver Order has the practical effect of impeding technological improvements in the 3d-Radar system because this condition locks into a very particular version of the device.

CWCI did not expect nor request that the waiver Order be narrowly tailored to a specific version of 3d-Radar that existed almost two years ago. CWCI also presumes that the Commission did not intend to prevent technological *improvements* to the 3d-Radar system, given its important public interest benefits. This petition seeks a modification of the waiver conditions so that the 3d-Radar system, as it was described in CWCI's waiver request and as it may evolve due to natural technological advancements, is covered by the waiver Order. To be clear, the requested modification would simply permit CWCI to market 3d-Radar devices (including those with new frequency step modulation systems) whose operating parameters comply with the technical and operational

requirements of the Commission's UWB GPR rules and the modified waiver Order. These new modulation systems feature larger frequency steps, faster cycle speeds and/or shorter dwell times that are more similar to conventional UWB GPR operations.

A modification of the waiver conditions is appropriate because (i) the waiver Order would then cover current and future 3d-Radar devices with operating parameters more similar to conventional UWB operations and which will comply with the emission limits and other technical and operational requirements of the UWB GPR rules, (ii) the Commission should encourage (not inhibit) such technological advances, and (iii) the advanced devices represent an important improvement from a safety and public interest perspective, particularly in ensuring the safety of our nation's transportation infrastructure.

CWCI respectfully requests that the Commission expeditiously grant this petition so that 3d-Radar systems can continue to bring even greater benefits to the public.

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PETITION FOR RECONSIDERATION AND CLARIFICATION

Pursuant to Section 1.106 of the Commission's rules, 47 C.F.R. § 1.106, Curtiss-Wright Controls Inc. ("CWCI") hereby petitions for reconsideration and clarification of the Waiver Order released on January 11, 2012 in the above-captioned matter.[1] CWCI appreciates the Commission's efforts in granting the Waiver Order. However, certain conditions imposed in the Waiver Order will hinder the deployment of CWCI's advanced Part 15 ultra-wideband ("UWB") ground penetrating radar ("GPR") system, known as 3d-Radar, when those conditions are not, in fact, necessary.

In 2010, CWCI sought a waiver of certain UWB rules in order to certify 3d-Radar systems which the waiver request described as "an array of closely spaced transmitting/receiving antennas that transmit sequentially over a large band of spectrum and gather data from a wide swath of underground structures in a single pass."[2] CWCI understands that the Commission deemed certain

[1] *In the Matter of Curtiss-Wright Controls Inc., Request for Waiver of Part 15 of the Commission's Rules Applicable to Ultra-Wideband Devices*, Order, ET Docket No. 10-167 (rel. January 11, 2012) ("Waiver Order").

[2] *In the Matter of Curtiss-Wright Controls Inc., Request for Waiver of Part 15 of the Commission's Rules Applicable to Ultra-Wideband Devices*, Request for Waiver, filed June 10, 2010 ("Waiver Request").

conditions necessary in granting the Waiver Request, but the wording of one condition has the practical effect of impeding technological improvements in GPR systems. Given that the Commission recognized the benefits of 3d-Radar, CWCI does not believe the Commission intended for the waiver conditions to be literally interpreted or overly restrictive. However, to avoid any doubt, CWCI requests that the Commission modify the first waiver condition in the Waiver Order to read as follows (with new language in bold and underlined): "The device shall operate with stepped frequency modulation in **at least** 2 megahertz steps between 140 MHz and 3 GHz with a scan/cycle rate of **no more** than approximately 3 milliseconds. The system may not **continuously** use any single frequency longer than 2 microseconds in any 3 millisecond period of time."

To be clear, the recourse requested herein would permit CWCI to market (subject to the modified conditions of the Waiver Order) 3d-Radar devices whose operating parameters comply with the technical and operational requirements of the Commission's UWB GPR rules. CWCI is asking the Commission to modify the waiver conditions so that the 3d-Radar system, as it was described in the Waiver Request and as it may evolve due to natural technological advancements, is covered by the Waiver Order. The Commission has already found that 3d-Radar has important public interest benefits, particularly in improving the safety of our nation's transportation infrastructure.[3] CWCI urges the Commission to expeditiously grant this petition so that the next and subsequent generations of 3d-Radar can bring even greater benefits to the public.

[3] *See* Waiver Order at ¶2.

I. The Waiver Order conditions need to be modified to accommodate ongoing technology advances.

The waiver was required, in part, because the 3d-Radar system does not satisfy the definitional requirements for GPR systems in the UWB rules. Section 15.503(d) requires that a UWB transmitter "at any point in time" has a fractional bandwidth equal to or greater than .20 or has a UWB bandwidth equal to or greater than 500 MHz. However, because each transmission in the 3d-Radar system is less than 500 MHz in bandwidth "at any point in time," the device does not meet this definitional requirement, even though the total bandwidth needed for optimal system performance exceeds 500 MHz. For example, the 3d-Radar device described in the Waiver Request transmits in discrete 2 MHz steps over 1,431 frequencies between 140 MHz and 3 GHz with a scan/cycle rate of approximately 2.86 milliseconds.

CWCI explained in the Waiver Request why the UWB rules should be waived to permit a fast, stepped-frequency emitter operating over a wide area of spectrum to qualify as a UWB device.[4] CWCI also pointed out that the FCC Lab indicated that the UWB minimum bandwidth requirement for a continuous wave emitter could be measured *over a single step or over a one millisecond* integration interval – criteria that the 3d-Radar system, now and future generations, will easily meet.[5]

In the Waiver Order, the FCC waives the UWB definitional requirement because it found the 3d-Radar system is functionally equivalent to UWB GPR devices.[6] The Waiver Order also recognizes that the primary difference between 3d-Radar and UWB GPR devices is the

[4] *See* Section II of Waiver Request entitled, "Rule 15.503(d) Should be Waived to Permit a Fast, Stepped-Frequency Emitter Operating Over Nearly 3 GHz of Spectrum to Qualify as a UWB Device," at pp. 3-6.
[5] *Id.* at p. 5.
[6] *See* Waiver Order at ¶14.

modulation scheme.[7] While UWB GPR rules were originally designed to accommodate devices that emit impulsive or transient-like signals in a bandwidth of at least 500 MHz, the 3d-Radar device uses stepped frequency modulation that transmits sequentially over a large band of spectrum in a bandwidth of well over 500 MHz.

However, the Waiver Order then requires the 3d-Radar device to operate with stepped frequency modulation in 2 MHz steps between 140 MHz and 3 GHz with a scan/cycle rate of approximately 3 milliseconds – locking in only a very particular version of the device.[8] The Waiver Order also imposes a limit on frequency dwell time which prohibits the system from using any single frequency longer than 2 microseconds in any 3 millisecond period of time.[9] These waiver conditions (including the dwell time limit depending upon how it is interpreted by the Commission[10]) effectively preclude CWCI from making any improvements to the 3d-Radar system – even those that will clearly improve spectrum efficiency and that will continue to meet the Commission's rationales for granting the Waiver Order.

For example, over the course of the nineteen months that it took to obtain the waiver, the 3d-Radar technology has advanced to where there are two new modulation systems incorporated into the device (one with 10 MHz steps and the other with 20 MHz steps) which feature a larger frequency step (increasing from 2 MHz steps to up to 20 MHz steps) over the same total bandwidth, faster cycle speed (changing from a 2.86 millisecond cycle to a faster 150 microsecond cycle) and shorter dwell time (decreasing from 2 microseconds to 1 microsecond). Although the new modulation systems utilize the spectrum more like a UWB device than the

[7] *Id.* at ¶15.
[8] *Id.* at ¶24.
[9] *Id.*
[10] *See* discussion in Section II herein.

specific device set forth in the Commission's first waiver condition, their operating parameters do not fall squarely within those set forth in the Waiver Order. And CWCI expects that 3d-Radar will continue to evolve as technological advancements are seen.

CWCI urges the Commission to revise the waiver conditions to expressly permit all 3d-Radar devices which are consistent with the parameters discussed herein. As discussed below, a modification of the waiver conditions is appropriate because (1) the Waiver Order would then cover current and future 3d-Radar devices with operating parameters more similar to conventional UWB operations and which will comply with the emission limits and other technical and operational requirements of the UWB GPR rules, (2) as a policy matter, the Commission should encourage (not inhibit) such technological advances, and (3) the advanced devices represent an important improvement from a safety and public interest perspective.

II. The Commission is justified in modifying the waiver conditions because (i) the operating parameters of the new 3d-Radar devices will be more similar to conventional UWB GPR operations and (ii) comply with the emission limits and other technical and operational requirements of the UWB rules.

CWCI's new 3d-Radar modulation systems will take larger (and fewer) steps over the same spectrum but in a shorter period of time, bringing the device closer to conventional UWB operations. As explained above, CWCI did not expect that the Waiver Order would be narrowly tailored to a specific version of the 3d-Radar device existing at the time the Waiver Request was filed in 2010. Because the Waiver Order specifies *exactly 2 MHz* frequency steps with a scan/cycle rate of *approximately 3 milliseconds*, these new 3d-Radar devices do not fall under the waiver. For example, the new modulation systems will employ a frequency step of either 10 MHz or 20 MHz, each with a dwell time of only 1 microsecond on any given frequency during a normal cycle. The cycle time for the 10 MHz step system will be 300 microseconds and for the

20 MHz step system it will be 150 microseconds. The scan/cycle rate of these 3d-Radar devices are significantly *less* than the 3 milliseconds specified in the Waiver Order (and less than the one millisecond interval proposed by the FCC Lab), but it is not clear that these cycle rates would be deemed to be "approximately 3 milliseconds" as specified in the waiver conditions. In order to ensure that these devices meet the conditions of the Waiver Order, CWCI requests that the Commission clarify that the scan/cycle and frequency step conditions in the Waiver Order were intended to set, respectively, maximum and minimum parameters, not rigid parameters related to one version of the device.[11]

There is no reason why the Commission should be concerned about modifying the Waiver Order to permit larger frequency steps or quicker cycles. The Commission has already concluded that, as long as it complies with the emission limits allowed for impulse GPRs, the risk of interference from the 3d-Radar device (which the Commission considered with 2 MHz steps and a cycle of 2.86 milliseconds) will be no greater than the risk of interference from other UWB GPR devices.[12] The devices with the new modulation systems will continue to operate between 140 MHz and 3 GHz. These devices will continue to operate when in contact with or within one meter of the ground, with their energy intentionally directed down in the ground. And, these devices will continue to be subject to the same emission limits, marketing and eligibility requirements as other UWB GPR devices and, therefore, the risk of interference from these new devices will be no greater than the risk of interference from other UWB GPR devices.[13]

[11] The fact that the cycle time must be "approximately" 3 milliseconds indicates a level of flexibility in the conditions.
[12] Waiver Order at ¶14.
[13] *Id.*

Reducing the dwell time from 2 microseconds to 1 microsecond will reduce the interference potential for a narrowband receiver by approximately 3 dB. And, increasing the frequency step sizes will increase the line separation in the frequency spectrum from 2 MHz to 10 MHz or 20 MHz, hence fewer frequency channels will be subject to potential interference.[14]

Regardless of the size of the frequency steps, the 3d-Radar devices with the new modulation systems will not emit in any specific narrow band indefinitely – a concern that was raised in response to the Waiver Request. As explained below, these devices will continue to be limited in dwell time. The Waiver Order limits the dwell time on a frequency to 2 microseconds in any 3 millisecond period of time. Presumably, the Commission looked to the 2 microsecond frequency step dwell time of the 3d-Radar device described in the Waiver Request as well as its cycle time of "approximately" 3 milliseconds (which is the approximate time it takes to go through 1,431 frequency steps and complete a single cycle) in setting the two measurements of this condition. It is important to remember that this condition was included in the Waiver Order to ensure that the 3d-Radar device does not emit in a specific narrow band "indefinitely" (in order to mitigate the risk of interference to licensed spectrum users).[15]

The 3d-Radar devices with the new modulation systems will not continuously dwell on a single frequency for more than 2 microseconds during any 3 millisecond period of time. For example, when a 3d-Radar device operates in 20 MHz steps, it will go through 143 frequencies

[14] For the 10 MHz and 20 MHz devices, RMS average emission levels in some of the steps will increase due to the shorter cycle time and the fact that the devices will complete multiple cycles during the 3 millisecond period. However, there is nothing in the record to indicate that this will increase the possibility of interference to the types of receivers operating in these bands. To the extent there is an issue, the system power will be adjusted to meet the emission limits of the UWB GPR rules.

[15] *Id.* at ¶16. There does not appear to be any special significance to the 3 millisecond time period of this condition other than it being an approximation of the cycle time of the 3d-Radar device described in the Waiver Request.

(at a faster pace, the new device will go through a single cycle in 150 microseconds) with a dwell time of approximately 1 microsecond per frequency step – thereby meeting the Commission's 2 microsecond limit. As a result of the faster pace, this device can complete twenty (20) cycles during a 3 millisecond period (not simply one cycle like the device described in the Waiver Request). When a 3d-Radar device operates in 10 MHz steps, it also has a dwell time of approximately 1 microsecond per frequency step and, thus, satisfies this dwell time condition.

However, CWCI notes that there is some ambiguity in the wording of the Waiver Order conditions and requests that the Commission clarify that the dwell time condition means that the device cannot ***continuously*** dwell on a frequency step for longer than 2 microseconds during a 3 millisecond period (or, in the alternative, during a single cycle of the device which may not exceed approximately 3 milliseconds). This modification appears consistent with the Commission's intent in the Waiver Order. Indeed, CWCI's Waiver Request and the Waiver Order both indicate that the cycle of the 3d-Radar device described in the Waiver Order is 2.86 milliseconds. Once a cycle is completed, then the next cycle automatically begins. This means that the 3d-Radar device that the Commission particularly considered will have completed one 2.86 millisecond cycle and started its second cycle for the remaining .14 milliseconds of the 3 millisecond time period set forth in this condition by the Commission. Those frequencies that are stepped through during that .14 millisecond period were previously stepped through at the beginning of that 3 millisecond period. In granting the Waiver Order, the Commission clearly did not interpret the dwell time condition as a restriction on the aggregate, non-continuous time the device spends on a given frequency step during the 3 millisecond period. If the Commission had done so, it would have realized that the aggregate, non-continuous dwell time of the waivered device during the 3 millisecond period on at least some frequencies would be 4

microseconds (*i.e.*, since the device would dwell, non-continuously, on certain frequencies for 2 microseconds two times for a total of 4 microseconds of dwell time) – thereby rendering even the 3d-Radar device that the Commission focused on non-compliant with the waiver condition. Therefore, CWCI requests that the Commission clarify that this condition is only meant to prohibit a *continuous* dwell time of more than 2 microseconds.

III. The Commission should encourage the evolution of 3d-Radar technology, and not inhibit such evolution by following rigid technical parameters.

Unexpectantly, the Waiver Order freezes the 3d-Radar technology to a specific configuration. This is not what CWCI requested in its Waiver Request.[16] As the technology continues to evolve, it would be unduly burdensome on both CWCI and the Commission to require a separate waiver every time a change is made in one of the parameters set forth in the Waiver Order, even when such change is clearly designed to make the system more UWB-like in its operation and the new device complies with applicable technical and operating requirements set forth in the Waiver Order. If CWCI were required to request a separate waiver for each and every such change, this would further delay the introduction of new and better devices designed primarily for public safety uses.

Such a rigid approach is contrary to the Commission's stated intent in its initial adoption of the UWB rules to encourage innovation in the development of UWB systems by applying flexible technical standards.[17] The Waiver Order should also not be so rigid as to prevent

[16] CWCI never asked the Commission for a waiver limited to the specific technical parameters of the 3d-Radar device described in the Waiver Request or expected the Commission to impose conditions that would impede the ongoing evolution of 3d-Radar devices. Indeed, in its Waiver Request, CWCI noted that "it is reasonable to assume that these [3d-Radar] systems will become the paradigm for GPR devices of the future." *See* Waiver Request at p. 20.

[17] The Commission stated, for example, that it would review the standards for UWB devices and "explore more flexible technical standards to address the operation of additional types of UWB operations and technology." *Revision of Part 15 of the Commission's Rules Regarding Ultra-*

improvements to the 3d-Radar technology or changes to the operating parameters that, for example, might be the result of technical advancements or required due to unforeseen interference issues.[18] Rather, the Commission should establish appropriate minimums and maximums that are consistent with its conclusions in the Waiver Order.

IV. There are clear and compelling public interest benefits for the Commission to grant this Petition for Reconsideration and Clarification and modify the Waiver Order.

The Commission has already found a strong public interest benefit in granting a waiver for 3d-Radar. Specifically, the Commission stated that the "waiver will allow the marketing of a new category of GPR devices that would increase efficiency in subsurface imaging, thereby potentially lowering costs of infrastructure repair and improving safety conditions for both infrastructure workers and the general public."[19] By modifying the waiver conditions as proposed, CWCI can continue to invest considerable time and resources in developing 3d-Radar in ways that further improve the efficiency in subsurface imaging and, consequently, enhance public safety.

For example, if limited to 2 MHz frequency steps, highway speeds for 3d-Radar operation are achievable only by reducing the horizontal sample density (increased spacing

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Wideband Transmission Systems, ET Docket No. 98-153, First Report and Order, 17 FCC Rcd 7435, 7436 ¶1 and 7525 ¶269 (2002).

[18] The Commission recognized the need for such flexibility in granting the UWB waiver to the Multi-band OFDM Alliance Special Interest, even overriding the petitioner's request for a waiver limited in scope. *See Petition for Waiver of the Part 15 UWB Regulations Filed by the Multi-band OFDM Alliance Special Interest Group*, ET Docket No. 04-352, FCC 05-58 (rel. March 11, 2005), 20 FCC Rcd 5528 (providing for the possibility that petitioner might eliminate operation on one or more channels proposed because of interference, and giving petitioner flexibility to operate using a different number of hopped, stepped or sequenced channels).

[19] Waiver Order at ¶8. The Commission's use of the phrase "a new category of GPR devices" rather than "a device" suggests that the Commission did not intend for the Waiver Order to be limited to a specific version of the device. The Commission also noted that the U.S. Department of Transportation supported the waiver to support its high speed rail initiatives. *Id.* at ¶18.

between samples across antenna and along motion direction), which impacts data quality. Using larger 10 or 20 MHz steps eliminates this limitation and, as a result, the systems can still maintain the safety of highway speeds and have improved data quality. Devices operating with 20 MHz frequency steps are best suited for shallow depths in combination with high resolution (*e.g.,* asphalt, concrete damage detection, and void detection in shallow to medium base). Devices operating with 10 MHz frequency steps are optimal where deeper depth is needed (*e.g.*, void detection in deep base layer). This kind of flexibility allows the user, including federal, state and local transportation authorities, to obtain the specific information they need to improve highway and bridge infrastructures.

There is no justification to limit natural technological advancements when the modified waiver conditions will continue to balance protecting licensed users with permitting an important product that furthers public safety. The Commission described 3d-Radar as a "new tool for evaluating and improving road and railroad infrastructure and [that] will aid in public safety."[20] It is in the public interest for the Commission to adopt policies and orders that encourage (not inhibit) such technological advancements for the public good. A modification of the Waiver Order as discussed herein will promote such technological development.

[20] *Id.* at ¶18.

V. Conclusion

In light of the above, CWCI respectfully requests that the Commission reconsider, and if necessary clarify, the Waiver Order as requested herein.

Respectfully submitted,

By: *__/s/ Jay S. Newman__*

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CERTIFICATE OF SERVICE

I, Moni Holmes, a secretary to the law firm Fish & Richardson P.C., hereby certify that a true and correct copy of the foregoing Petition for Reconsideration and Clarification was sent by first-class mail on February 10, 2012 to the following parties:

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